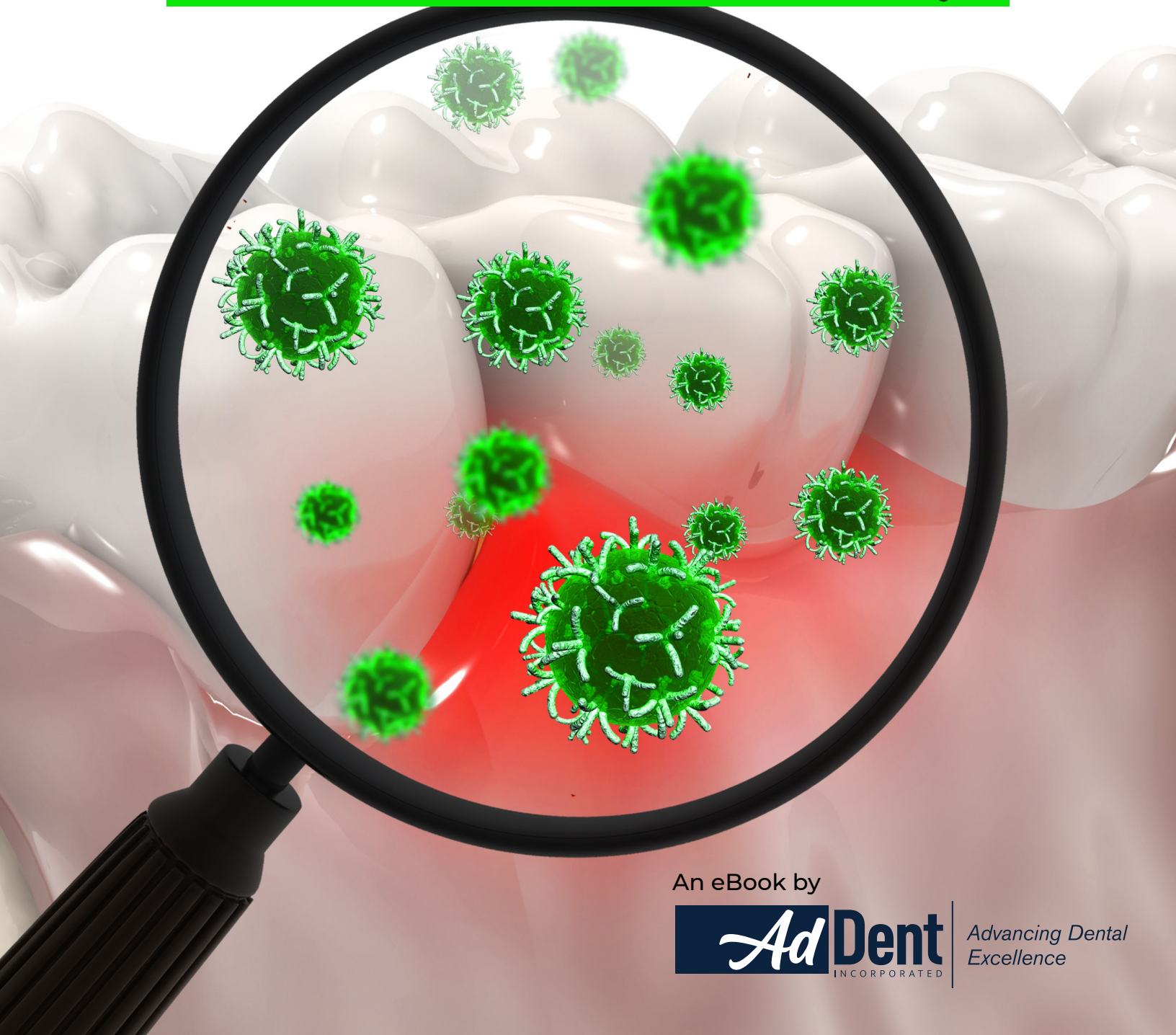
S U P P L E M E N T

HOW CAN BIOFILM AFFECT MY DIAGNOSIS AND TREATMENTS?

USE OF FLUORESCENCE-AIDED-IDENTIFICATION TECHNIQUE



An eBook by

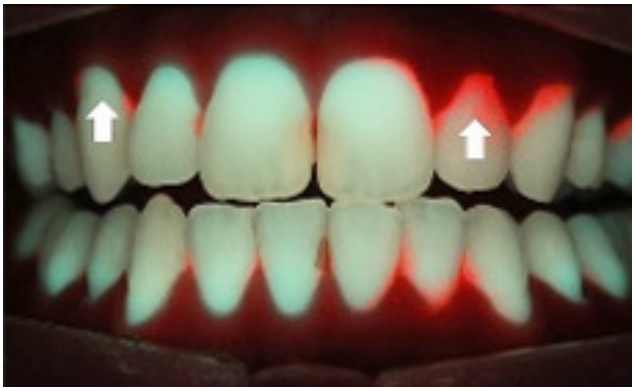
AdDent INCORPORATED

Advancing Dental Excellence

USE OF FLUORESCENCE-AIDED-IDENTIFICATION TECHNIQUE (FIT) FOR BACTERIA DISCLOSURE (CARIES, CALCULUS & PLAQUE)

When removing tooth decay, dentists may use a technique called "fluorescence-aided caries excavation" (F.A.C.E.), which involves using near-UV light at 405nm. F.A.C.E. takes advantage of the fact that bacterial porphyrins emit pink fluorescence. This creates a high contrast of color, which makes it a useful alternative to traditional detector dyes and stains. By using 405nm fluorescence, dentists can remove tooth decay more precisely, quickly, and cleanly. This approach also reduces the risk of staining the dentin enamel junction or producing false positives closer to the pulp chamber, resulting in a more predictable outcome.[1]

A study was conducted to test whether there are any differences in the effectiveness of visual and tactile methods compared to laser fluorescence in identifying early occlusal caries lesions in permanent teeth. The goal was to find a non-invasive way to detect caries and preserve tooth structure through minimally invasive dental treatment. The results showed that fluorescence-based techniques were more valid than visual and tactile methods in diagnosing occlusal caries in permanent teeth.[2]



The techniques based on fluorescence used in this study yielded better results than the so-called conventional methods. "Our results show that fluorescence-based techniques obtained greater internal and external validity than visual and tactile methods in diagnosing occlusal caries in permanent teeth."[2]

Near-UV (405nm) light detects mature dental plaque and calculus by emitting visible pink fluorescence from their deposits on teeth, restorations, or dental appliances.[3]

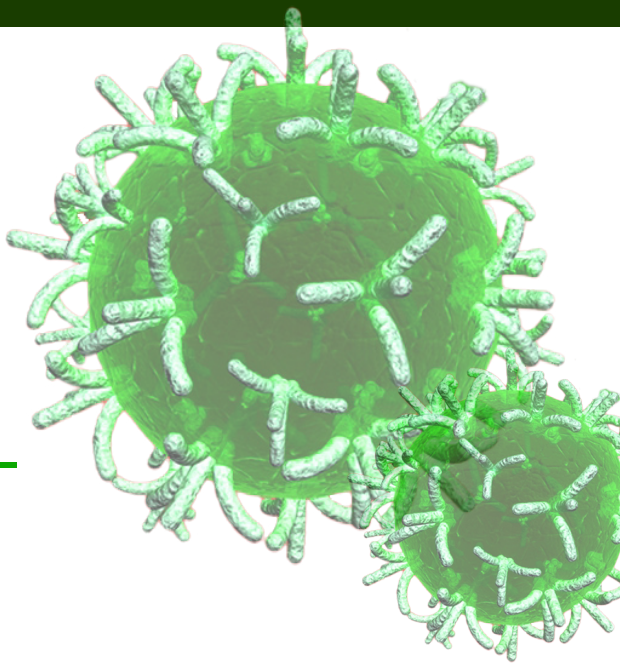
The pink fluorescence produced by bacterial porphyrins indicates the presence of plaque. This makes it possible to monitor and remove plaque during prophylaxis and periodontal treatments. Additionally, using this method to evaluate restorative margins can help to identify local plaque retention and detect any potential cement leakage or dissolution.[1]

USE OF FLUORESCENCE-AIDED-IDENTIFICATION TECHNIQUE (FIT) IN RESTORATIVE PROCEDURES

The fluorescence-aided identification technique (FIT) is a diagnostic tool to improve differentiation between composite resin restorative materials and sound tooth structure.

In the repair and replacement of composite restorations, there is a risk of removing healthy tooth structures or leaving behind composite remnants during preparation due to the difficulty in distinguishing between tooth structure and composite. Composite remnants can lower the quality of future adhesive restorations. Additionally, overlooked fillings can lead to inaccurate dental charting, which could result in incorrect assessments of caries risk and improper treatment.

The Fluorescence-aided Identification Technique (FIT) is a noninvasive tool to distinguish composite resin material from sound tooth substance, making the detection and removal of tooth-colored fillings easier for dentists.[4]



FIT is a diagnostic method that is more accurate, reliable, and faster than conventional illumination. When composite resin is illuminated with FIT, certain fluorescent components cause it to appear brighter than the tooth structure.[5]

USE OF FLUORESCENCE-AIDED-IDENTIFICATION TECHNIQUE (FIT) IN PERIODONTICS

Periodontitis, a chronic infectious disease of the oral cavity, is most often caused by bacteria and subgingival calculus and can result in tooth loss. To effectively treat periodontal disease, it is crucial to accurately distinguish between dental calculus and healthy teeth. Hence, it is important to assess the capability of detecting subgingival calculus to ensure complete calculus removal during scaling and root planning. In 1953, it was noted that dental calculus on teeth surfaces showed reddish-orange fluorescence under UV light.[6]

The emission spectra from supra- and subgingival calculus under a wide range of excitation wavelengths were investigated. The fluorescent emission was strongest for excitation wavelengths from 400 to 420 nm, and human dental calculus could be differentiated from clean root surfaces by emission spectrophotometry.

The results indicated that this method enabled cost-effective and reliable calculus detection and can be further developed for imaging applications. A fluorescence-based procedure to enable real-time detection and quantification of dental calculus was developed.[7]

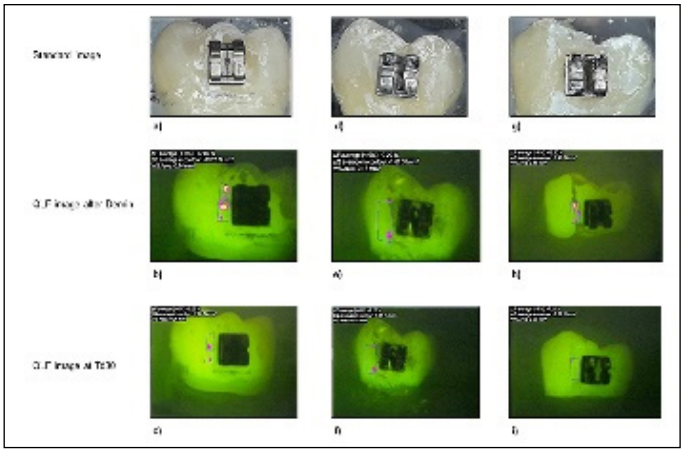
Biofilm removal is crucial for maintaining periodontal and peri-implant health, which is necessary for successful implant therapy in the long term. Failure to remove mature biofilm can result in calculus formation, whether it is subgingival or supragingival.[8]

USE OF FLUORESCENCE-AIDED-IDENTIFICATION TECHNIQUE (FIT) IN ORTHODONTIC PROCEDURES

During fixed orthodontic treatment, enamel demineralization can occur as an undesirable side effect. If left unchecked, initial lesions may worsen and result in cavities, potentially leading to the premature removal of orthodontic appliances. To prevent this, it is crucial to modify caries risk factors and prioritize management strategies that focus on re-mineralizing the affected areas.

Near-UV-induced fluorescence at 405nm is more effective than visual examination in detecting white spot lesions in enamel. A significant decrease in the intensity of the fluorescence signal occurs in both demineralized teeth and teeth with dentine carious lesions.[9]

While many studies have focused on the best way to remove composite, less attention has been given to finding a method to effectively remove any remaining composite. By using the differences in fluorescence properties between luminescent chemicals and tooth structures under a wavelength of 405 nm, fluorescence can be a useful non-invasive tool for detecting composites. The use of the FIT for cleanup after orthodontic debonding resulted in superior removal of composite remnants and took less time.[10, 11]



The technique of using phosphoric acid to etch human teeth enamel creates bonding infiltration between 10-20 µm. However, due to this infiltration, it is not possible to completely remove composite remnants without damaging the

enamel surface. Even though the teeth might appear clean clinically, the primer and sealant agent can remain on the teeth when using conventional light. In the long term, the resin-infiltrated enamel may cause color changes. With the FIT method, this infiltrated enamel layer becomes visible and can be removed during the clean-up process. [10, 11]

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